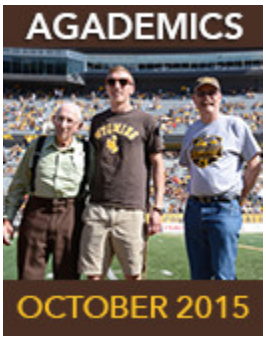
October 2015



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Scientists want to develop bloodstream bacterial drones to kill tumors

By Ann Tanaka | October 2015

Professor Mark Gomelsky and his team is developing a method to counter a cancer tumor's ability to fool immune cells and deliver programmable nonpathogenic bacteria directly to the tumor.

Talk of building smart bombs, counterintelligence and infrared light-guided delivery systems may have raised a curious eyebrow from anyone walking by the open conference room door on the sixth floor of the University of Wyoming building.

A peek at those gathered at the table in the College of Agriculture Building may (or may not) have disarmed any alarm: bearded molecular biologist Mark Gomelsky and clean-shaven immunologist Jason Gigley from UW and demure bacteria-engineering expert Jill Zeilstra-Ryalls from Bowling Green State University in Ohio.

They were explaining their strategy: release special forces carrying programmed devices to infiltrate deep into an enemy's territory, counter enemy propaganda, and then, using infrared light, trigger detonation without harming the surrounding population.

Gomelsky and members of his interdisciplinary team – that also includes UW molecular biologist Anya Lyuksyutova – says the war on cancer will be won, and they want to use bacteria and the body's own immune system to do it.

It's not science fiction: it's science.

"Humankind is probably for the first time at the edge of actually curing most cancers," says Gomelsky. "I think this will happen in our lifetime. That is a bold statement. While most people don't realize it, this is going to happen, and our own immune systems will be the key."

They want to use what they call bacterial drones, or bactodrones, as cancer-targeting, remotely controlled weapons, in contrast to chemotherapy and radiation – the shotgun approach, says Gomelsky.

Key advances in immunology have opened new avenues of cancer treatment. Gomelsky says several companies are successfully using the weakened pathogenic bacteria listeria as an anticancer treatment in clinical trials.

They work with listeria as well, but the team wants to test the nonpathogenic bacteria Rhodobacter.

Bacteria tinkering specialist Zeilstra-Ryalls explained Rhodobacter bacteria can sneak under the radar of the immune system and reach tumors without causing disease anywhere in the body. Plus, these bacteria glow naturally in the presence of infrared light so they can reveal tumor locations in the body. Gomelsky and Zeilstra-Ryalls have previously collaborated on Rhodobacter projects.

Finding a way to induce a person's immune system to fight tumors the same way the immune system fights infectious diseases was an exciting cancer-battling advance, says Gomelsky.

The survival of a tumor depends on its ability to trick immune cells to stand down.

"Tumors turn the immune cells into their companions and servants, so to speak," says Gomelsky.

Advances in the study of tumor microenvironments have revealed how tumors trick immune cells. Turns out that, because of this trickery, bacteria can accumulate and survive inside tumors. The body's immune system attacks bacteria in healthy tissues but does little to bacteria growing inside tumors.

The team wants to use that free pass to "intoxicate" tumors and overcome the tumor's no-worries directive to immune cells.

The scientists already know how to engineer genes into bacteria that encode products toxic to tumor cells and those that can awaken the immune cells from the tumor-imposed stupor.

"We want to help the immune system recognize tumors just like it recognizes pathogens. Once the immune system is mobilized, it can start fighting tumors," says Gomelsky.

Enormous progress has been made recently in removing those tumor immunity directives using specific antibodies, but in many cases the awakened immune cells still don't recognize the cancer cells as invaders. Immune cells may be ready to fight but need to know what to attack, says Gomelsky.

The team believes that, by exposing tumor cells killed by bacteria, they will alert immune cells to what they should attack.

"Bacteria serve as a vehicle for delivering genes we want inside the tumor," Gomelsky says. "We also want to control when these genes begin to work inside tumors."

Not easy to do, Gomelsky says.

"You can trigger the production of these tumor-killing and immune cell-awakening bacteria with something as benign as light," Gomelsky says, "the same kind near-infrared light that is used in remote control devices for televisions and other electronics."

Infrared light penetrates deep into human tissues.

"The genetic tools that we are developing will allow us to remotely control the bacteria inside tumors," he says.

Critical discoveries in immunology have unlocked secrets of the tumor microenvironment, notes Gigley.

"Tumors are your own self, and a natural part of the immune system is to not fight yourself," he says. "Tumors have been very difficult to target because of that."

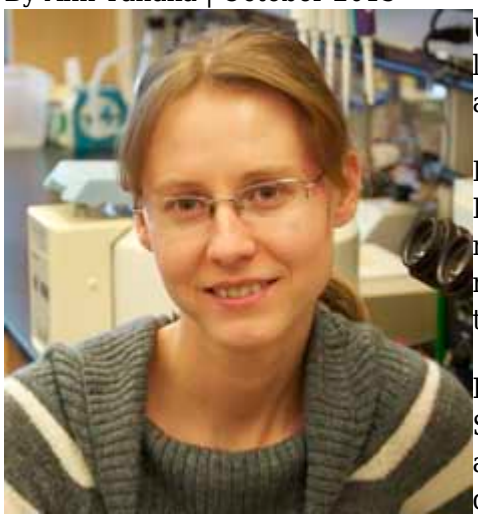
The point of using a bacteria-based system is not only to kill the tumor that's present at the time, but to retain immunological memory – the immune system will remember and kill tumor cells and not allowing the cancer to recur, he noted.

There are obstacles to the team's success – lack of adequate funding and physicians' skepticism about injecting cancer patients with live bacteria.

“And finally, we have yet to show that we can control bacteria inside the body,” says Gomelsky. “We have developed this technology and are on the verge of demonstrating it. Not yet in humans… but in mice as a starting point.”

UW research using C. elegans worms leads Kirienko to cancer research at Rice

By Ann Tanaka | October 2015



Natasha Kirienko

University of Wyoming graduate Natasha Kirienko has spent a decade learning what a worm can teach about disease in humans, leading to an assistant professor position with Rice University.

Kirienko was introduced to *Caenorhabditis elegans* in molecular biology Professor David Fay's "Wyoming Worm Lab." *C. elegans* is a transparent nematode with a genome similar to that of humans. She praises this rapidly multiplying, millimeter-long creature as having a genetic toolkit that is nearly unrivaled in other model organisms.

Kirienko arrived at the University of Wyoming in the fall of 2004 from Southern Federal University in Rostov-on-Don, Russia, after completing a bachelor of science degree in biochemistry (2002) and master's degree in biology (2004).

"Basically, it's the story of an excellent Ph.D. student in molecular biology who went on from UW to complete a very successful postdoc at Harvard and is now a new professor at Rice – one of the nation's top universities," says Fay.

"Natasha was an absolute standout," he notes. "She was a fearless experimentalist and an extremely hard worker."

After earning a doctorate in molecular biology in 2009 from UW, Kirienko further investigated *C. elegans* as a postdoctoral research associate at Harvard Medical School and Massachusetts General Hospital from 2010 to 2015. There, she used *C. elegans* as a host for the human pathogen *Pseudomonas aeruginosa*, which is particularly dangerous for people with cystic fibrosis or compromised immune systems. It is responsible for more than 150,000 infections a year in hospitals and other healthcare facilities – many of them fatal – and it is developing resistance to antibiotics. Kirienko sought new treatments.

Later in 2015, she was recruited by Rice University as an assistant professor of biosciences through a state-funded organization that aims to attract world-class research scientists with distinguished professional careers. Called the Cancer Prevention and Research Institute of Texas (CPRIT), the organization supports first-time, tenure-track faculty members in addition to its other programs.

As a CPRIT Scholar backed with $2 million in grant funding, Kirienko wrangles *C. elegans* to develop cancer-fighting therapies and new approaches to treat antimicrobial-resistant bacteria.

Her work at UW laid the foundation, she says.

"Most of my work for David focused on cancer research," she notes. "Now, as a CPRIT Scholar in Cancer Research, a big part of the work in my lab will focus on how a certain biological process that is important for maintaining mitochondria (the part of the cell most responsible for energy generation) is involved in cancer initiation and progression."

Her laboratory continues seeking treatments for antimicrobial-resistant bacteria.

“As antimicrobial misuse continues at a virtually unchecked pace, resistance has flourished making new treatments desperately needed,” she says.

Interacting with Kirienko as a professor and colleague is fun, says Fay.

“This was one case where the high potential of the student was clear from the beginning,” he says. “I’m just glad to have been able to help Natasha on her way.”

UW research on Rio Grande virus leads to NIH fellowship

By Ann Tanaka | October 2015

Mitchell Szymczak

Groundbreaking biomedical research completed in the College of Agriculture and Natural Resources has led to a National Institutes of Health fellowship for Mitchell Szymczak, who graduated in 2015 with a bachelor of science degree in microbiology.

Szymczak is now in Bethesda, Maryland, conducting post-baccalaureate research in the Epithelial Signaling and Transport Section of the National Institute of Dental and Craniofacial Research.

He works in a laboratory that studies calcium signaling in pancreatic and salivary gland cells that secrete fluid and digestive enzymes. According to the website, the goal is to learn more about mechanisms related to inflammatory autoimmune diseases such as acute pancreatitis that can lead to multisystem failure and Sjögren's syndrome, a disorder that affects the exocrine glands that produce saliva and tears.

At UW, Szymczak studied Rio Grande virus of the family *Bunyaviridae*, genus *phlebovirus*

According to veterinary sciences Assistant Professor Myrna Miller, this little-known virus, native to the U.S., is related to other pathogenic viruses affecting humans, such as Rift Valley fever virus and sand fly fever viruses.

Working at the Wyoming State Veterinary Laboratory, Szymczak determined the morphology of the virus using negative contrast and thin-section electron microscopy. He discovered antigenic cross-reactions between Rio Grande virus and Rift Valley fever virus that could result in false laboratory diagnoses.

"Mitch's research was also the first time the whole genome sequence of Rio Grande virus was determined, allowing him to determine its phylogenetic relationship with other viruses in the genus," Miller says.

She noted Szymczak's growing confidence as he completed two undergraduate research projects in her laboratory. One was funded through a competitive undergraduate research fellowship from a program (INBRE) of the National Center for Research Resources and the National Institutes of Health. The purpose of the Institutional Development Award (IDeA) Networks of Biomedical Research Excellence (INBRE) program is to augment and strengthen the biomedical research capacity of an IDeA-eligible state. See more at http://bitly.com/INBRE-UW.

The Institutional Development Award (IDeA) Networks of Biomedical Research Excellence (INBRE) program augments and strengthens the biomedical research capacity of an IDeA-eligible state. See more at http://bitly.com/INBRE-UW.

As a student, Szymczak presented this work in a poster session at the 2014 Rocky Mountain Virology Association meeting hosted by Colorado State University and was awarded a travel grant to attend the American Society of Microbiology Clinical Virology Symposium in Daytona Beach, Florida, this year.

Szymczak has had his first peer-reviewed paper on Rio Grande virus research accepted for publication. A second paper is in the works.

New equine program to expand opportunities throughout state

By Ann Tanaka | October 2015

Jennifer Ingwerson is an equine specialist and assistant lecturer with the Department of Animal Science.

The University of Wyoming has a pony mascot, Cowboy Joe, a bucking horse logo, and a new charge to expand its equine studies program.

Enter Jennifer Ingwerson (and her quarter horse Debbie). Ingwerson joined the College of Agriculture and Natural Sciences in August 2014 to take the reins of the equine program within the Department of Animal Science.

The program encompasses academic teaching, UW Extension, and coaching the Collegiate Horse Judging and Ranch Horse Versatility teams, activities that roughly define the seasons for Ingwerson.

“Fall is competitive season,” she says.

The Versatility Ranch Horse competitions includes ranch trail, reining, ranch pleasure, and working cow horse events.

The competition raises awareness and appreciation of the working stock horse. This year, UW Ranch Horse team members compete against other collegiate teams in two sanctioned shows in Colorado. Ingwerson’s goal for the team eventually is to have a horse and rider in every event.

Unlike the Ranch Horse Team, which is a club, Collegiate Horse Judging Team members must enroll in Advanced Equine Evaluation and Selection, the second in a two-course sequence. Ingwerson coaches students on how to evaluate horses on the basis of breed standards for conformation and performance.

The ideal horse is not, however, a random collection of standards. Students learn how conformation relates to overall function and longevity of the animal. For example, team members must know arm from elbow, pastern from poll, and be able to recognize a trappy (choppy) or rope-walking stride (both undesirable). Competitive horse judging helps develop skills in observation, discernment, organization, and verbal communication.

The team represents UW at two major competitions: the American Quarter Horse Congress Oct. 14 in Columbus, Ohio, and the American Quarter Horse World Show Nov. 18 in Oklahoma City.

Ingwerson admits that another fall course, Advanced Equine Welfare and Behavior, is her favorite. By the time students enroll, they’ve been immersed in science-based studies in equine nutrition, physiology, and reproductive processes and have become familiar with the equine industry.

Students choose topics from today’s equine industry and engage in debate. They are randomly assigned a position and are evaluated on the quality of their preparation – not which side they represent.

“Horses are different from other livestock,” says Ingwerson. “They walk the line of livestock or pet, depending on the person. Horses stir people’s emotions and are often seen as a symbol of the American West.”

Students examine the morals, values, ethics, and thorny realities of human-equine relations.

Horse slaughter is one controversy they've debated.The federal ban in the U.S. has increased the number of horse welfare cases.

It's a relevant topic says Ingwerson.

Not even the university's signature bucking horse escapes the scrutiny of Ingwerson's students as they debate the welfare of rodeo stock at events such as Cheyenne Frontier Days.

Again, the best prepared party is the winner of the debate–not who is right or wrong.

For Ingwerson, though, there is one certainty.

"I worked in industry for a while, and I missed teaching. I love the intellectual challenge of it, the learning and growing, and the giving back to the state and even the nation."

Ingwerson grew up in eastern Nebraska, where her family raised quarter horses. She earned a bachelor's degree in animal science from the University of Nebraska-Lincoln and a master's degree at Iowa State University in equine reproductive physiology.

Ingwerson notes that Wyoming enjoys broad support of horses throughout the state. "You really see that at UW's spring rodeo," she says. "It is a community event with standing room only."

Ingwerson travels the state as a UW Extension specialist. Last summer, she hosted four horse clinics around the state and instructed at the annual horse camp in Douglas in which 4-H equine members learned basic showmanship and horsemanship. One of her goals is to assemble a state advisory committee with the Wyoming state 4-H office to help expand the program.

The image of the bucking horse adorns the license plates of every car, truck, and trailer of the state, and the UW campus features no less than five larger-than-life statues of horses and riders. According to one estimate, Wyoming is the "horsiest" state in the nation on the basis of human population, horse population, and geographic size (E.R. Kilby, "The Demographics of the U.S. Equine Population").

Still, Ingwerson sees the need to make horse education more widely available to Wyomingites inside and outside UW classrooms. Her goal is to strengthen the foundation, unify programs, and generally build equine education in Wyoming.

Ingwerson states she has seen strong support for all equine activities from UW students and administrators, youths, parents, and community members.

"We want to keep up the momentum for expanding our equine program," she says.

No slides are available in this gallery

In appreciation

By Ann Tanaka | October 2015

No slides are available in this gallery

Outstanding Alumni Award recipients Bud Christensen and Ken Hamilton, the John P. Ellbogen Foundation, which received the Legacy Award, Outstanding Research Partner Anadarko, and Professor KJ Reddy, the Andrew Vanvig Lifetime Distinguished Faculty Achievement Award recipient, were recognized at the dean's banquet and during halftime of the UW-New Mexico football game September 26.

Ag Appreciation Weekend barbecue raises more than $11,000

By Ann Tanaka | October 2015

No slides are available in this gallery

More than 565 were served at the annual Ag Appreciation Barbecue Saturday, September 26, in the Indoor Practice Facility. The event raised more than $5,800 in donations and more than $5,700 in ticket sales. Proceeds after expenses benefit College of Agriculture and Natural Resources student organizations and a student scholarship.

Department of Molecular Biology Seminars

By Ann Tanaka | October 2015

Fridays, 2:10-3 p.m., Berry Center Auditorium, room 138 –

- **October 2**: “Unraveling Redundancy during Morphogenesis in the *C. elegans* Embryo,” Paul Mains, University of Calgary
- **October 9**: “Divide and Polarize: The Role of Cytokinesis and Endocytic Transport during Epithelia Polarization,” Rytis Prekeris, University of Colorado Denver
- **October 16**: “Following the Linker: Cytoskeletal Control of Bacterial Cell Wall Remodeling,” Erin Goley, Johns Hopkins University
- **October 23**: “Nose Picking for Progress: Mining the Nostril Microbiome for New Insights into Pathobionts,” Katherine Lemon, Forsyth Institute
- **October 30**: “Beyond the Code: Mitotic Regulation by DNA and Histones,” Hironori Funabiki, Rockefeller University

Monies Awarded

By Ann Tanaka | October 2015

Monies Awarded:

- **Baumgartner, Robert**: $26,498 from Dow Chemical for “Corn Hybrid Screening,” and $2,200 from various sponsors for “Crop Research.”
- **Hess, Bret**: $100,000 from U.S. Department of Agriculture Agricultural Research Service for “Collaborative Long-Term Agro-Ecosystem Research (LTAR) Efforts in the High Plains and Thunder Basin.”

Proposals Submitted

By Ann Tanaka | October 2015

Proposals Submitted:

- **Bowman, Grant**, and Rongsong Liu: $625,462 to National Science Foundation for “A Scaffolding Protein is a Multivalent Hub for Organizing Bacterial Cytoplasm.”
- **Cammack, Kristi, Kathleen Austin, Scott Lake, Steven Paisley, Daniel Rule**, Gavin Conant, William Lamberson, Rebecca Cockrum, and Shanna Ivey: $500,000 to U.S. Department of Agriculture (USDA) National Institute of Food and Agriculture (NIFA) for “Genetic and Maternal Influences on Progeny Rumen Microbiome and Feed Efficiency.”
- **Despain, Johnathan, Dawn Sanchez, and Justina Russell**: $91,012 to National 4-H Council for “4-H National Mentoring Program.”
- **Gigley, Jason**: $150,000 to Wyoming March of Dimes for “Biochemical Identification and Dissection of *Toxoplasma gondii* Membrane Fusion Proteins
- **Griffith, Coleman**: $3,400 to Wyoming Department of Agriculture (WDA) for “Frank Wise Community High Tunnel Project.”
- **Hess, Bret**: $25,000 to USDA Agricultural Research Service for “Growth Efficiency and Carcass Traits of Breed-Composite Rams,” $113,487 to USDA NIFA for “Funding for 4th Quarter of McIntire-Stennis Competitive Forestry Research,” $221,029 for “Funding for 4th Quarter Hatch Multistate Formula Funds,” $337,669 for “McIntire-Stennis Competitive Forestry Research Act, McIntire-Stennis Formula Funds,” $782,144 for “Hatch Programs (Multistate),” $1,290,455 for “Hatch Formula Program,” and $1,290,455 for “Hatch Formula Funds.”
- **Horn, Blaire, John Scasta**, Ryan Fieldgrove, and Barry Crago: $19,995 to WDA for “Comparing Cattle Nutritional Plane to Forage Quality to Determine Mineral Intake and Deficiencies.”
- **Hufford, Kristina, Peter Stahl**, and Brad Fedy: $205,525 to Bureau of Land Management for “Improving Success in Habitat Restoration for Sagebrush-Obligate Wildlife: Assessment of Avian Habitat Use, Vegetation, and Plant Community Assembly in Sagebrush Steppe Reclamation Activities.”
- **Jarvis, Donald**, and Christoph Geisler: $189,238 to National Institutes of Health for “Glycoengineered Insect Cells for Commercial Biologics Manufacturing.”
- **Schumaker, Brant**: $24,817 to Western Sustainable Agriculture Research and Education for “Increasing Sustainable Agriculture through Enhanced Diagnostics with Brucella Infection.”
- **Smith, Mae, and Brian Mealor**: $20,000 to WDA for “Bighorn Targeted Goat Grazing.”
- **Smith, Mae, Barton Stam**, Shawn Heinert, and Paul Koehn: $15,600 to WDA for “Granite C&H Allotment Rangeland Health Assessment Program.”

Changing Faces

By Ann Tanaka | October 2015

Welcome:

- **Benson, Janet,** Washakie County UW Extension, administrative assistant (9/28)
- **Cook, Lori**, UW Extension communications and technology department, administrative assistant (9/24)
- **Lenhart, Cinnamon**, Campbell County UW Extension, 4-H educator (10/5)